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(54) User access system using proxies for accessing a network

(57) Access system and method for enabling access to a local area network (14) from a client (12), e.g. through a publicly accessible network (18). A connection between the client (12) and a network server (151,152,153) is established not directly but through a client proxy means (11) located at the client (12) and a proxy server (13) at the local area network (14). The connection between the client proxy means (11) at the client (12) and a proxy server (13) at the local area net-

work (14) may be established through a firewall restricting access to the local area network (14) and/or client (12). In establishing the connection, ports of the client proxy means (11) at the client side may be mapped in multiple steps to the ports of network servers (151,152,153) of the local area network (14). The invention allows to execute services as for example ftp, http, IMAP and similar at the client side for accessing data or services at the local area network side.

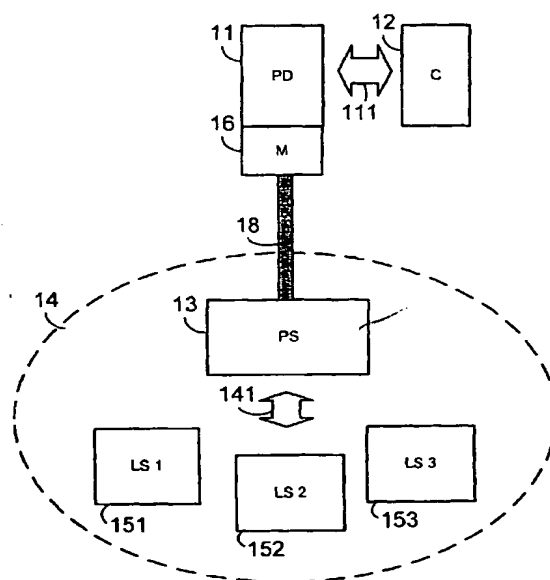


Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to an access system and a method for enabling a user to access a local area network, e.g. using a public network.

BACKGROUND OF THE INVENTION

[0002] Today's public and private communication networks are increasingly used for applications involving data transmissions over networks of data processing devices. For example, growing numbers of financial transactions or access sessions to review, retrieve or manipulate data are executed over public networks and it is of high importance to prevent access to personal data by unauthorized parties and to provide a secure data transmission link for executing these transactions. However, at the same time it is desirable that an authorized user may conveniently access the service.

[0003] If a secure transmission line between a client and a local area network is available, convenient user access is established relatively easy. However, in case a local area network is accessible from a remote host for example via a public network like the Internet, avoiding unauthorized access from the public network to the local area network generally requires complex security measures which may make it difficult for a user to obtain convenient access to services available at the local area network.

SUMMARY OF THE INVENTION

[0004] It is therefore desirable to provide an access system and corresponding method for enabling improved access from a client to a local area network.

[0005] An access system for enabling a user to access a local area network may comprise client proxy means adapted to exchange data with a client data processing device and with at least one network server of the local area network through a proxy server. Further, the access system may comprise connection means for establishing a data transmission link between the client proxy means and the proxy server, selecting at least one of the network servers based on the request, and for establishing a communication link between the client proxy means and the network server involving the data transmission link.

[0006] According thereto, the client data processing device may not directly access a desired one of network servers at a local area network, but instead transmits the request to client proxy means for further execution. The connection means may select a network server for serving the request and a data transmission link may be established between the client proxy means and a proxy server and further, a communication link between the client proxy means and the network server may be es-

tablished via the data transmission link, thus allowing the network server to serve the request.

[0007] Further, the network server may be selected based on a port at the client proxy means receiving the request and/or by information included into the request and the communication link between the client proxy means and the network server may include a port of the client proxy means and a port of the network server.

[0008] The connection means may be arranged to generate a list of assignments between at least one port of the client proxy means and at least one port of the at least one network server and may be arranged for retrieving corresponding mapping rules, the mapping rules at least including information on establishing the data transmission link between the client proxy means and the proxy server. The mapping rules may further include address information of the at least one network server of the local area network.

[0009] The connection means may comprise first sub-connection means for mapping at least one port of the proxy server to at least one port of the client proxy means; second sub-connection means for mapping at least one port of the at least one network server to at least one port of the proxy server; and wherein the mapping is in accordance with the retrieved mapping rules.

[0010] The data transmission link between the proxy server and the client proxy means may involve a secure communication via a public network and an authorization procedure for authorizing, may be executed at the client data processing device, e.g. by a user at the client data processing device. The data transmission session with the client proxy means may be established through a firewall restricting access to the local area network from the outside.

[0011] The connection means may comprise means for mapping a port of the client proxy means to a port of the firewall and means for mapping the port of the firewall to a port of the proxy server.

[0012] The client data processing device may be part of a client network and the data transmission link between the client proxy means and the proxy server is further established through a firewall restricting access to the client network from the outside.

[0013] The proxy server may be located inside a firewall restricting access to the local area network from the outside and may be configured to allow access only to selected network servers.

[0014] The client proxy means may be registered as a proxy at the client data processing device for executing an application that is proxy enabled, i.e. allows registering a proxy. Further, at the client data processing device the name of a network server may be replaced by the name of the client proxy means and a specific port for an application that is not proxy enabled.

[0015] An access method for enabling a user to access a local area network may include receiving a request from a client data processing device at a client proxy means, establishing a data transmission link be-

tween the client proxy means and a proxy server, determining one of the at least one network servers based on the request, establishing a communication link between the client proxy means and the network server involving the data transmission link, and authorizing the network server to serve the request.

[0016] Further advantageous embodiments of the invention are disclosed in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

- Fig. 1 shows a block diagram illustrating elements of the system for enabling access to a local area network according to an embodiment of the invention;
- Fig. 2 shows a flow diagram illustrating steps of the method according to another embodiment of the invention.
- Fig. 3 shows a block diagram illustrating elements of the system for enabling access to a local area network according to an embodiment of the invention;
- Fig. 4 shows a flow diagram illustrating steps of the method according to another embodiment of the invention.
- Fig. 5 shows a flow diagram of a time sequence of transmissions according to another embodiment of the invention;
- Fig. 6 shows a flow diagram of a time sequence of transmissions according to another embodiment of the invention;
- Fig. 7 shows a block diagram illustrating elements of the system for enabling access to a local area network according to an embodiment of the invention;
- Fig. 8 shows a block diagram illustrating elements of the system for enabling access to a local area network according to an embodiment of the invention involving access through a firewall;
- Fig. 9 shows a block diagram illustrating elements of the system for enabling access to a local area network according to an embodiment of the invention involving access through a firewall;
- Fig. 10 shows a block diagram illustrating elements of the system for enabling access to a local

area network according to an embodiment of the invention including a client side network;

- Fig. 11 shows a flow diagram of a time sequence of transmissions according to another embodiment of the invention;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] In the figures corresponding elements are denoted by corresponding reference numerals.

[0019] In the following an embodiment of the invention will be described with respect to Fig. 1. Fig. 1 shows a block diagram of an access system for enabling access to a local area network according to an embodiment of the invention.

[0020] Fig. 1 illustrates elements of an access system including a client proxy means 11 for exchanging data with a client data processing device 12 via a connection 111. Further, Fig. 1 shows connection means 16 for connecting the client proxy means 11 and a proxy server 13 via a data transmission link 18. Still further, Fig. 1 shows as three exemplary network servers 151, 152 and 153 connected to the proxy server 13, e.g. via a communication network such as a local area network 14, as illustrated by an arrow 141.

[0021] The access system of the shown embodiment provides, e.g. a user operating the client data processing device 12, improved access to information on the network servers 151, 152 and 153 through the client proxy means 11 and the proxy server 13, e.g. for requesting services from the network servers such as obtaining data files, starting applications and similar.

[0022] In the embodiment illustrated in Fig. 1, the client data processing device 12 does not directly access a desired one of the network servers, instead the client proxy means 11 executes the request on behalf of the client data processing device 12. Upon detecting a request from the client data processing device, preferably the connection means 16 may determine one of the at least one network servers based on the request, establish the data transmission link 18 between the client proxy means 11 and the proxy server 13 and establish a communication link between the client proxy means 11 and the network server involving the data transmission link.

[0023] This may be particularly advantageous in case a direct communication between the client data processing device 12 and the network servers is not possible, e.g. due to access restrictions or similar restricting access to the local servers and/or the local area network 14.

[0024] In the following the elements of the access system of Fig. 1 will be described in further detail.

[0025] The client data processing device 12 may be a general purpose data processing device, a mobile terminal, such as a mobile computer, a mobile phone, a

mobile data organizer or similar. The client data processing device 12 preferably is equipped with communication means for communicating with other data processing devices, e.g., a modem or similar, and communicates with the client proxy means 11 via a connection 111, which may be a communication link via a dedicated line, via a network or similar, including wireless transmission and internal connections, e.g. an internal connection in a data processing device. The connection 111 may be a temporary connection, established on demand upon generation of a request at the client data processing device 12, and may be maintained for further requests. Requests may for example relate to a retrieval of data from the network servers, relate to execution of an application at the network servers or similar.

[0026] The client proxy means 11 may be constituted by a dedicated data processing device or may be realized by a code section executed for example at the client data processing device 12. The client proxy means may be located at an arbitrary location, however, it may be preferred to locate the client proxy means in close proximity to the client data processing device, e.g. to ensure short communication paths which may be more easily protected from unauthorized listening.

[0027] The client proxy means preferably acts on behalf of the client data processing device in executing at least some of the requests generated at the client data processing device, i.e. the client proxy device may act as a proxy for the client data processing device.

[0028] In general, a proxy is an entity which is authorized to act on behalf of another entity, i.e., to execute operations such as communication requests on behalf of the requesting entity. As common in network applications, a proxy receives, e.g., a request for data from a requesting device and retrieves the data on behalf of the requesting device. Since in network applications usually the destination address as well as the originating address is specified, the proxy preferably includes his own address as originating address. Therefore, any requested data will be transmitted back to the proxy. After receiving the requested data the proxy transmits the requested data to the requesting entity, e.g. a data processing device of a user who wishes to access information on a public network such as the Internet.

[0029] In the present case the client proxy means 11 may be registered as a proxy at the client data processing device 12 to handle at least some of the requests generated at the client data processing device 12, or the client data processing device 12 may be configured by other means to transmit at least some requests to the client proxy means 11. The client proxy means after receiving a request from the client data processing device 12, retrieves the requested data and then transmits the requested data to the client data processing device.

[0030] The connection means 16 is responsible for establishing the required connection between the client proxy means and the appropriate network server. The connection means 16 may be a dedicated data process-

ing device connectable to the client proxy means 11 or may be constituted by a code section executed at a data processing device such as the client proxy means 11 and/or the client data processing device 12 or similar.

5 [0031] In particular, upon reception of a request from the client data processing device 12 at the client proxy means 11, the connection means 16 may select at least one of the network servers for serving the request. The selection may for example be based on information included into the request, an identifier transmitted in association with the request and/or a particular service or service type requested in connection with the request. For facilitating a selection, the connection means 16 may maintain for example information on services available at the network servers and/or address information of the network servers.

10 [0032] The selected network server may also be responsible for further routing the request, i.e. act as a gateway or proxy for further distributing the request to further network servers. Particularly in case for example a plurality of network servers is available for serving a particular type of request, the selected network server may act as a gateway or proxy for further distributing the request.

15 [0033] The connection means preferably also establishes the data transmission link 18 between the client proxy means 11 and the proxy server 13, e.g., via a network such as the Internet and/or via a dedicated communication line including wireless transmissions. The data transmission link 18 may be referred to as a "tunnel", as it may pass or tunnel elements restricting access to the local area network 14, such as firewalls etc., and may be used to establish a secure connection through a publicly accessible network, as outlined with respect to further embodiments. Establishing the data transmission link 18 may involve contacting the proxy server 13 and the client proxy means 11 and negotiating a communication protocol between these two devices, for example involving a particular method of exchanging data and/or security measures. The data transmission link 18 may be established on demand, e.g. upon request from the client proxy means 11, in case the client proxy means 11 receives a request for data from the client data processing device 12, or may be established once at system set-up and then may be maintained throughout operation time. The data transmission link 18 may accommodate a plurality of communication links between at least one client and at least one network server.

20 [0034] Still further, the connection means 16 preferably establishes a connection between the client proxy means and the selected network server involving the data transmission link 18. This preferably includes instructing the proxy server to connect to the selected network server. Thus, the communication link will use a transmission path from the client proxy means 11 through the proxy server 13 to the selected network server. The partition of the communication link between the client proxy

means and the proxy server will thus use the transmission link 18 as transmission medium or carrier. The partition of the communication link from the proxy server to the selected network server may be a connection as common in network applications involving packet switched communication or any other connection and may be established on demand through the client proxy means 11 upon reception of a request, but may be maintained for further connections involving the same client and the same network server and e.g. the same type of request.

[0035] The connection means 16 may be realized as one or more dedicated data processing devices or by code sections executed at e.g. the client proxy means and/or the client data processing device.

[0036] The proxy server 13 may be a data processing device, for example a data processing device with large capacity for serving a large number of client requests. The proxy server 13 may act as a proxy, i.e. executes requests on behalf of another entity, in the present case for example upon request of the client proxy means 11. The proxy server 13 is connectable to the network servers 151, 152 and 153, as illustrated by an arrow 141. The connections may be temporary connections, established e.g. on demand upon generation of a request at the client data processing device 12, but may also be maintained for further requests.

[0037] The network servers 151, 152 and 153 may for example be data servers having large capacity for serving a large number of client requests and/or for storing large amounts of data. Even though only three network servers are shown, it is understood that an arbitrary number of network servers may be provided inside and outside the local area network 14. The proxy server 13 and the network servers 151, 152 and 153 are shown to be connected via the local area network 14, however, it is also possible that the proxy server and the network servers are connected via dedicated communication lines or via a wide area network such as the Internet or a combination of networks. Finally, it is possible that some of the network servers are part of the local area network 14, while other network servers are part of other networks while being accessible through the proxy server 13.

[0038] The access system of the shown embodiment provides improved access for, e.g. a user operating the client data processing device 12, to information on the network servers 151, 152 and 153, even if direct access to network servers is not possible due to access restrictions at the local area network. Access may be obtained from the client data processing device 12 through the client proxy means 11 and the proxy server 13, e.g. for requesting services from the network servers such as obtaining data files, starting applications and similar.

[0039] In the following a further embodiment of the invention will be described with respect to Fig. 2. Fig. 2 shows a flow diagram of a sequence of steps of the method according to another embodiment of the inven-

tion.

[0040] As the previous embodiment, the steps outlined with respect to this embodiment allow improved access to a local area network from a client data processing device by employing a client proxy means, a proxy server and connection means.

[0041] In a first step S21 a request from a client data processing device is received at the client proxy means 11. The request may for example be a request for data, or a request for a particular service, such as the execution of an application program or similar. As an example, a user operating the client data processing device could generate a request concerning the display of a particular document at the client data processing device. This request could be for example generated by entering a particular network address specifying a storage location of the requested document at the client data processing device or by clicking onto a correspondingly marked area on a display associated with the client data processing device 12 or could be generated by clicking onto an icon on a display associated with the client data processing device. The request may contain information on a requested document and/or service and may contain information on the client data processing device originating the request and similar.

[0042] In a step S22 for example the connection means 16 establishes a data transmission link or "tunnel" between the client proxy means 11 and proxy server 13. This may involve sending a connection request to the proxy server 13, negotiating communication protocols, encryption methods, and similar.

[0043] In a step S23 for example the connection means 16 may determine one of the at least one network servers based on the request from the client data processing device 12. For example, information on the desired network server may be included into the request and/or the desired network server may be determined based on an identifier transmitted in association with the message and/or may be determined based on a type of request received at the client proxy means 11. For example, in case the request from the client data processing device 12 includes a request concerning e-mail services, e.g. the connection means 16 determines a network server providing e-mail services. In case the request from the client data processing device 12 includes a request concerning a html (hyper text markup language) document, the connection means 16 may determine a network server providing http (hyper text transport protocol) services. As common in network applications, the selected network server may also be a gateway or proxy for further distributing the request.

[0044] The client proxy means may maintain information on the available network servers and services provided by the network servers.

[0045] After an appropriate one of the network servers is determined based on the request, in a step S24 a communication link between the client proxy means and the network server is established via the data transmis-

sion link previously established between the client proxy means and the proxy server. The communication link may be a communication link as common in network applications involving packet switched transmissions and may therefore be a point to point bi-directional connection. The communication link between the client proxy means and the network server may be established only for serving a single request or may be maintained after serving the request for further requests, e.g. with similar contents.

[0046] Thereafter, in a step S25 the request is served by the network server. Service may include retrieving data from the network server through the proxy server based on the request and transmitting the data to the client data processing device or may include executing an application at the network server under control of the client data processing device 12. This may involve a bi-directional communication between the network server and the client data processing device 12 via the established communication link, e.g. for interactively controlling the execution of an application at the network server via the client data processing device 12, e.g., for scrolling through a document or for editing purposes or for displaying parts of image data such as a bitmap. Serving the request may also include a bitmap protocol or X Windows protocol or similar.

[0047] Serving the request may also include further distribution of the request to further network servers.

[0048] It is noted that the sequence of steps outlined above may be altered, in particular step S22 may generally be executed at any time, for example before step S21 or after step S23.

[0049] In the following a further embodiment of the invention will be described with respect to Fig. 3. Fig. 3 shows a block diagram of an access system for enabling access to a local area network according to another embodiment of the invention.

[0050] Further to the elements of Fig. 1, Fig. 3 shows a browser 121 and an IMAP (Internet message access protocol) application 122 running at the client data processing device 12. The client data processing device 12, the client proxy means 11 and the connection means 16 are arranged at a client side 15, e.g., located at a user wishing to access services provided by the system.

[0051] In the present embodiment the client data processing device 12 does again not directly access a desired one of the network servers, instead the client proxy means 11 and the connection means 16 execute the request on behalf of the client data processing device 12 by determining one of the at least one network servers based on the request, establishing the data transmission link 18 between the client proxy means 11 and the proxy server 13 and by establishing a communication link between the client proxy means 11 and the network server involving the data transmission link.

[0052] The browser 121 is connectable via a connection 311 to a port 11a of the client proxy means 11 and the email application 122 is connectable via a connec-

tion 312 to a port 11b of the client proxy means 11. Further, network servers 151, 152 and 153 are shown having ports 151a, 152a, 152b and 153a, respectively, for receiving data from the proxy server via connections 313, 314, 315 and 316. The ports may, e.g. receive packets of data. The connections 311 - 316 may be temporary connections, established on demand upon generation of a request, but may be maintained operable for further requests. Further, the connections 311 - 316 preferably allow a bi-directional communication, i.e. data can be transmitted in both directions via a connection once it is established.

[0053] The elements at the client side 15 and the local area network 14 are shown as part of a wide area network 17, such as a public network, for example the Internet or any other network.

[0054] The client data processing device 12 may run application programs generating requests for data or messages, for example the browser 121 for browsing information or transmitting data in data communication networks. Generally, a browser may be constituted by a piece of software which, when run at a client, allows a user to browse through a set of data, i.e., a browser is a program that may serve as a front end to a network such as the World Wide Web on the Internet. In this case, a user may enter an address of a web site into a browser's location field and a corresponding home page will be downloaded for local display. Further, the user may enter the address and name of a particular document, in which case the document will be downloaded for display. The downloaded information may, if visualized, serve as an index to other pages on the web site which can be accessed by clicking on for example a "click here" message, high-lighted text or an icon on the screen.

[0055] Further, the client data processing device 12 may run an application program as for example the IMAP application 122, e.g. a mail processing application for sending, receiving and handling of e-mail documents remotely on one of the network servers.

[0056] Further applications requiring access to the network servers may be provided, such as applications for remotely controlling the execution of application programs at a local server.

[0057] In the present case the client proxy means 11 handles requests generated at the client data processing device 12. Thus, requests, e.g. generated by the browser 121, will be sent to the client proxy means 11 for execution. It is possible that all requests generated at the client data processing device 12 are transmitted to the client proxy means for further handling. However, it is also possible that only selected requests are sent to the client proxy means 11, e.g. requests of a particular type or generated by a particular application at the client data processing device 12. In this case requests which are not transmitted to the client proxy means 11 may be directly executed at the client data processing device 12, i.e. these requests may be directly transmitted over

a network such as the Internet, as known in the art.

[0058] The client data processing device 12 and the client proxy means 11 in Fig. 3 are illustrated as separate entities and it is to be assured that requests are transmitted from the client data processing device to the client proxy device. Therefore at the client side 15 means may be provided for registering the client proxy means as a proxy at the client data processing device in case the client data processing device executes an application, e.g. browser 121 and/or IMAP application 122, that is proxy-enabled. This assures that the requests from the client data processing device are sent to the client proxy means. Registering the client proxy means as a proxy may be accomplished for example by entering a network address of the client proxy means at the client data processing device. For example, applications that are proxy-enabled may provide an option to register another device as proxy by entering a network address into a specified location on a display. A proxy-enabled browser may thus provide means for entering an IP-address and a port number for a specific service, i.e. communication type requested. Entering the IP-address and the corresponding port number at the client, e.g. at the client browser or the mail processing system, effects that all requests from the respective applications at the client data processing device are transmitted to the corresponding port at the client proxy means. In case of an http-request, e.g. from browser 121 of the client data processing device 12, will be transmitted to port 80 of the processing device, e.g. port 11a. Also, any IMAP request from the IMAP application 122 will therefore preferably be sent to the processing device to port number 143, i.e. port 11b.

[0059] In case an application is not proxy-enabled, the application does not provide means for registering a proxy, such as the client proxy means 11, and therefore in case an application which is not proxy-enabled is executed at the client data processing device, e.g. a non proxy-enabled browser and/or a non proxy-enabled IMAP application, the name of a network server is replaced by the name of the client proxy means and the appropriate port. This may be accomplished by a software program run at the client data processing device and will effect that requests of an application to the network servers 151, 152 or 153, will only be sent to the client proxy means 11.

[0060] The client data processing device 12, i.e. the browser 121 and the mail processing application 122 are connected to the client proxy means 11 via connection 311 for exchanging data. The connections 311, 312 between the client proxy means 11 and the data processing device 12 may be a standard packet-switched connection or any other connection for exchanging data. In case of packet-switched connections, as shown in Fig. 1, the connection 311 will have a starting point at the client data processing device 12 and an ending point or port at the client proxy means 11. In the shown example the communication path 311 from the

browser 121 ends at a port 11a at the client proxy means 11, and the connection 312 from the IMAP application ends at port 11b at the client proxy means 11.

[0061] As common in networks, e.g., in packet oriented networks, each connection is characterized by an origin and a communication end point. Each communication end point is constituted by a port having a specific predetermined number and a receiver address, i.e. the address of a particular machine. For each communication type a specific port is provided. Common port numbers for standard communication types are port number 80 for http (hyper text transport protocol), port number 21 for ftp (file transfer protocol), port number 25 for SMTP (Simple Mail Transfer Protocol) and port number 143 for IMAP (Internet Message Access Protocol).

[0062] Data packets are routed from the originating entity to the communication end point. Therefore, a packet can be routed to a destination using the IP- (Internet Protocol) address of the destination device and an appropriate port number. For example, a selected hyperlink, e.g. selected by clicking on it using a standard browser will be translated into an IP-address and a port number using a domain name system (DNS). If for example a browser connectable to a network such as the Internet attempts to retrieve an html document from the Internet, the corresponding data providing device storing the requested document will be addressed using its IP-address and further, the http-port, i.e. port number 80, will be specified.

[0063] In the present embodiment as an example it is assumed that port 11a is arranged to receive http requests from the browser 121, and the port 11b is arranged to receive IMAP requests from the IMAP application 122. In this case communication end point 11a would have a port number 80 and communication end point 11b would have a port number 143. However, in other examples any other configurations are possible, e.g., multiple communication paths from an application etc..

[0064] Further, Fig. 3 shows a proxy server 13 for exchanging data with the client proxy means 11 over a communication link 18 and for exchanging data with the network servers, for example as outlined with respect to the previous embodiments. Any communication between the proxy server 13 and the network servers 151, 152 and 153 may for example be realized via the local area network 14 involving packet switched transmission, however, any other communication type may be employed as well, including dedicated communication lines and wireless transmissions.

[0065] The proxy server 13 may also be constituted by a dedicated data processing device, or may be constituted by an application program executed on a data processing device at the same time used for other purposes.

[0066] The proxy server 13 includes communication starting points 13a and 13b, e.g., for handling requests of a certain type. In the present case it is for example

assumed that starting point 13a is responsible for http requests and that starting point 13b is responsible for IMAP application requests. However this is an example for illustration purposes, for example only one starting point for handling multiple types of request may be provided instead.

[0067] The connection 313 between the proxy server 13 and the network server 151 starts at the starting point 13a of the proxy server and ends at a port 151a of the local server 151. The connection 314 between the proxy server and the network server 152 runs from the starting point 13a at the proxy server to a port 152a of the local server 152. The connection 315 between the proxy server and the network server 152 runs from the starting point 13b of the proxy server to the port 152b of the network server 152. Still further, connection 316 between the proxy server 13 and the network server 153 runs from starting point 13a of the proxy server to the port 153a of the network server 153.

[0068] In the present case it is for example assumed that the ports 151a and 152a and 153a are ports responsible for handling http requests, for example for communicating with the browser 121 at the client data processing device 12. Further, in the present case it is for example assumed that port 152b is a port responsible for handling IMAP requests, for example for communicating with the IMAP application 122 at the client data processing device 12. Thus ports 151a and 152a and 153a could be ports corresponding to port 11a at the client proxy device 11, and port 152b of local server 152 could correspond to port 11b of the client proxy device 11.

[0069] In the example of Fig. 3 network servers 151 and 153 only include one port, in the example for handling HTTP requests, whereas network server 152 shows two ports, in the example port 152a for handling HTTP requests and port 152b for handling IMAP map requests from. However, this is an example only, the network servers may have any number of ports and further types of ports than the two depicted, for HTTP and IMAP may be provided, for example for FTP, SMTP, Gopher, etc. Correspondingly, the data processing device 12 may execute further application programs, for example for FTP, SMTP or Gofer.

[0070] The connection means 16 at the client side 15 may be responsible for establishing a data transmission link 18 between the client proxy means and the proxy server 13 and/or selecting a network server and/or establishing the communication link between the proxy server and the selected network server. Information, e. g., network servers, services, client identities, on communication protocols, encryption methods, interfaces in the transmission path and similar may be maintained in a memory accessible by the connection means 16.

[0071] For establishing a data transmission link 18 between the client proxy means and the proxy server 13 the connection means may contact the proxy server with a connection request. Thereafter a communication pro-

tolocol may be negotiated including encryption methods and similar. Preferably the client proxy means 11 maintains information on the configuration of the proxy server 13 in order to appropriately contact the proxy server.

[0072] The communication link 18 may include transmissions through a wide area network 17, for example a public network such as the Internet or may be accomplished by any other network or a dedicated communication line, including wireless transmissions. The data transmission link 18 is suited to accommodate a plurality of communication links from the client side 15 to the local area network 14.

[0073] The connection means 16 further selects at least one of the network servers 151, 152 and 153 based on the request received at the client proxy means 11 from the client data processing device 12. Further, the connection means may select a port at the selected network server. To facilitate a selection, the connection means 16 may maintain information on the local area network 14, in order to be able to select appropriate network servers.

[0074] This may include information on at least one of the group consisting of

- network servers available,
- services available on the network servers, i.e. port numbers,
- identifiers of users authorized for access.

[0075] The information on the available network servers of the local area network 14 and/or services and/or users may be maintained in a database at the client side 15 or any other location. Further, this information could for example be retrieved from the local area network 14 before serving a request or could be transferred before starting an access session.

[0076] The selection of one of the network servers and/or a port at one of the network servers may be based on a type of request received. For example, if a request is received from the IMAP application 122 at port 11b at the client proxy means 11, the connection means 16 may select an e-mail port on a server at the local area network 14, for example port 152b at network server 152 for serving the request. This selection may be based on information maintained at the connection means 16 on available network servers and/or services available at the network servers.

[0077] If for example a request for an html document is received at port 11a of the client proxy means 11 from the browser 121, the connection means 16 may select a corresponding port one of the network servers providing HTTP services, such as for example ports 151a, 152a, 153a of network servers 151, 152 and 153.

[0078] In case a plurality of network servers is available for serving the request, the connection means 16 may select one of the available network servers based

on information maintained at the connection means 16, which act as a gateway or proxy for the corresponding type of request and may then distribute the request based further information included in the request, e.g. an URL of a particular document desired, as known in the art.

[0079] Further, it is possible to transmit this request to a dedicated site at the local area network 14 for analyzing the request and handling further distribution of the request to an appropriate network server, e.g., based on a URL contained in the request and/or a further identifier contained in the request such as a user identifier. Thus the connection means may only maintain information on one responsible network server (i.e. dedicated site) for each type of request. It is also possible that the proxy server 13 analyzes the request and further distributes the request to an appropriate network server.

[0080] Further, the selection may be based on a network server identifier transmitted with the request, for example in case an application generating the request is configured to communicate with a predetermined network server.

[0081] The selection may also be based on a data type requested. If for example a html document is desired, a http server could be selected. The selection may also be based on an application requested or on the identity of a user.

[0082] The connection means 16 may directly analyze the request from the client data processing device 12, in order to determine an appropriate network server for handling the request. A network server could be directly specified in the request or could be derivable from the request.

[0083] For example, in case the request contains information such as a URL of a particular document or an identifier of a particular e-mail account, the connection means could base the selection of the network server on this information.

[0084] In brief, the selection of a network server may be based on at least one of the group consisting of

- a type of request,
- a network server identifier transmitted with the request,
- a port number of a port at the client proxy means receiving the request,
- a data type requested,
- an application requested.

[0085] Further, the connection means 16 is preferably responsible for establishing communication links between the client proxy means 11 and an appropriate one of the network servers 151, 152 and 153. The communication link between the client proxy means 11 and the

local server will be established through the data transmission link 18 provided between the client proxy means 11 and the proxy server 13. This may involve mapping, i.e. assigning at least one port of the client proxy device 11 to at least one port of the network servers, possibly in multiple steps. Preferably in a first step a port of the client proxy means 11 may be mapped to a port of the proxy server 13. In a second step the port of the proxy server 13 may be mapped to a port of the selected local server. This may include instructing the proxy server 13 to perform the required assignment with a mapping message from the connection means 16. The connection means may further authorize the selected network server to serve the request.

[0086] In order to establish the communication link the connection means may include sub-connection means for mapping at least one port of at least one of the network servers 151, 152 and 153 to at least one port of the client proxy means 13. The sub-connection means may be located at the client proxy means and/or at the proxy server. For example, port 11a of the client proxy means for receiving e.g. http-requests from the browser 121, may be mapped to port 151a of the network server 151 and/or port 152a of the network server 152, assuming that ports 151a and 152a are http ports. The other ports may be mapped similarly. It is noted that this is an example only, further ports at the network servers or at further network servers may be provided.

[0087] The connection means may also comprise a further sub-connection means for mapping at least one port of the proxy server 13 to at least one port of the client proxy means 11.

[0088] The information on establishing the data transmission link 18 between the client proxy means 11 and the proxy server 13, and the information for facilitating a selection of one of the available network servers at the local area network 14 and establishing the communication link between the client proxy means 11 and the selected local server could also be stored in a memory as mapping rules which are retrieved by the connection means 16 upon receiving a request at the client data processing means 11.

[0089] Thus, the connection means may be arranged to select one of the network servers and to retrieve corresponding mapping rules, for example including information on establishing a secure transmission link to the destination proxy server. This may include information on configuring the client proxy means and/or the proxy server in accordance with the request received, in establishing the transmission link to the proxy server based on the transmission medium to be used, e.g. a public network, and the specific configuration of the proxy server of the local area network 14. Therefore, the rules may include information on the type of transmission link to be established to the proxy server 13, and/or the communication type requested, and/or the required configuration of the client proxy means 11, the configuration of the proxy server 13 and similar.

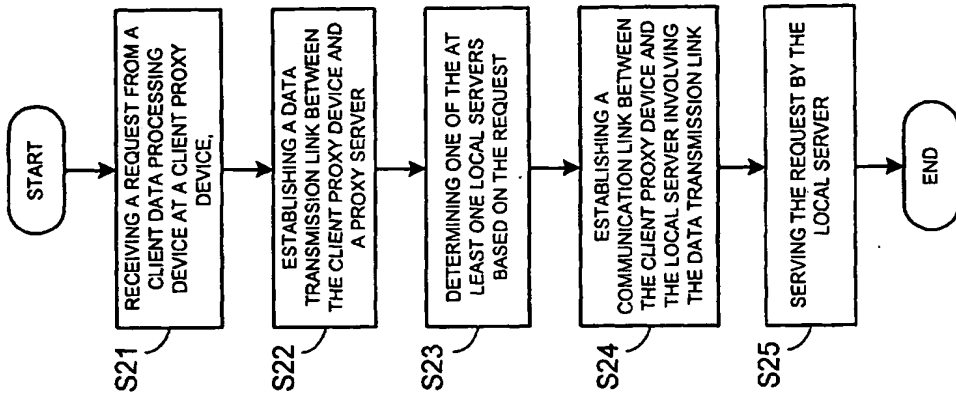


Fig. 2

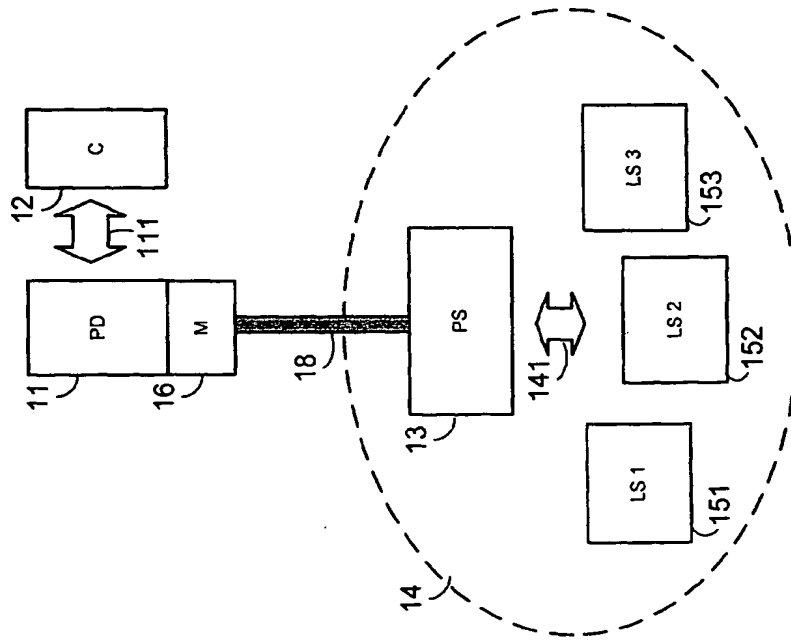


Fig. 1

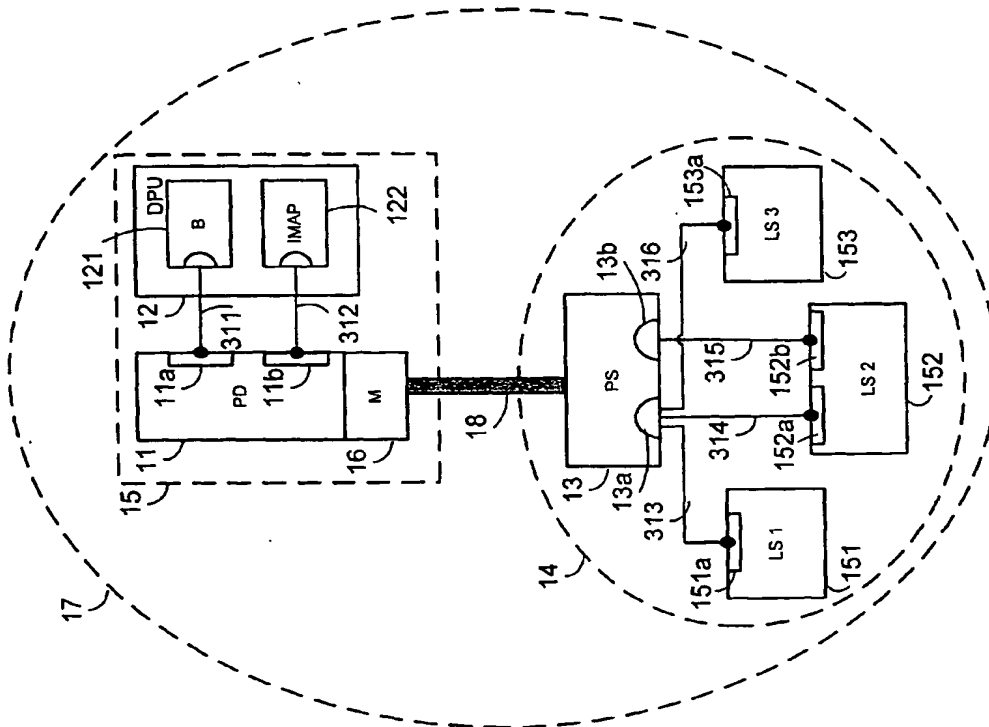


Fig. 3

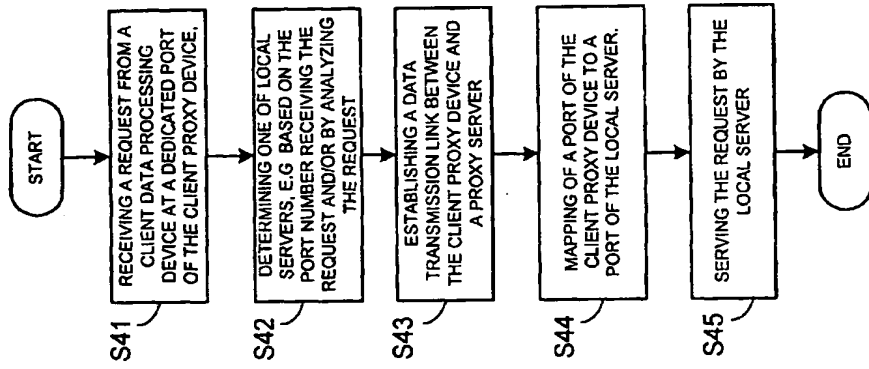


Fig. 4